ORDER

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

7470.1

SUBJ: DISTANCE MEASURING EQUIPMENT (DME)/DME INFRASTRUCTURE EVALUATION FOR AREA NAVIGATION (RNAV) ROUTES AND PROCEDURES

1. PURPOSE. This order provides guidance and standardization for Distance Measuring Equipment (DME)/DME infrastructure evaluation in support of Area Navigation (RNAV) route and procedures development.

2. DISTRIBUTION. This order is distributed in Washington headquarters at the division level of Flight Standards, branch level of Air Traffic, the offices of Airport Safety and Standards and Communications, Navigation, and Surveillance Systems; the Aviation System Standards National Flight Procedures Office; the Regulatory Standards and Compliance Division at the Mike Monroney Aeronautical Center; regional Flight Standards Offices, Air Traffic (AT) Service Areas, all air traffic field offices and facilities, and special military and public addresses.

3. EFFECTIVE DATE. This order is effective November 1, 2004.

4. BACKGROUND. Many RNAV aircraft systems use information from multiple DMEs to determine the aircraft's position. Procedures and routes relying on this capability require evaluation to determine if the DME/DME coverage provides adequate support.

a. The FAA is responsible for evaluating DME/DME coverage against a minimum standard (baseline) DME/DME RNAV system for each route and procedure authorized to use DME/DME RNAV. The FAA will assess if adequate DME/DME coverage is available on the routes and procedures using a combination of a computer tool (assessing if the available DME/DME performance is adequate) and flight inspection (to validate the reception and performance of individual DME facilities). This document establishes the procedures for the DME/DME infrastructure evaluation and its operational implementation.

b. The assessment of DME/DME coverage will also determine if an expanded service volume (ESV) is necessary for select DME facilities. The implementation of DME/DME will also impact the long-term sustainment and implementation of DME facilities to support these operations.

c. All DME facilities maintained by the FAA and used to define the availability of these RNAV routes or procedures comply with applicable ICAO facility maintenance and performance standards and several added requirements necessary to support RNAV operations. It is recognized that the FAA cannot ensure that foreign DMEs (e.g., Canadian & Mexican DME facilities) meet ICAO standards for use on these domestic RNAV routes and procedures. In circumstances where alternatives are not viable (i.e., GPS required), and the National Airspace Procedures

Team (NAPT) concurs with continued procedure development, the FAA may coordinate with foreign authorities to ensure DME performance.

5. DEFINITIONS. Definitions are contained in Appendix 1.

6. RELATED PUBLICATIONS.

a. Order 7100.9, Standard Terminal Arrival Program and Procedures

b. Order 7400.2, Procedures for Handling Airspace Matters

c. Order 7930.2, Notices to Airmen (NOTAMs)

d. Order 8260.3, United States Standard for Terminal Instrument Procedures (TERPS)

e. Order 8260.19, Flight Procedures and Airspace

f. Order 8260.40, Flight Management System (FMS) Instrument Procedures Development

g. Order 8260.43, Flight Procedures Management Program

h. Order 8260.44, Civil Utilization of Area Navigation (RNAV) Departure Procedures

i. Order 8260.46, Instrument Departure Procedure (DP) Program

j. Advisory Circular 90-US RNAV, US Terminal Area Navigation (RNAV) Operations

7. FORMS. Appendix 2 is the format for Required Data for DME Infrastructure Evaluation.

8. DME/DME INFRASTRUCTURE EVALUATION PROCESS.

a. General. The following guidance outlines procedures for conducting DME/DME infrastructure evaluation in support of RNAV procedure development. Procedure development normally begins within Terminal or En Route & Oceanic Service Areas, with Air Traffic Facilities or industry proponents, and tracks through the development process to approval at the national level. Figure 1 depicts the evaluation process.

(1) The Flight Operations Simulation and Analysis Branch (AFS-440) has developed the FAA approved DME/DME evaluation tool. This tool is available via Internet and shall be used to perform the computer assessment of the DME infrastructure supporting a specific route or procedure.

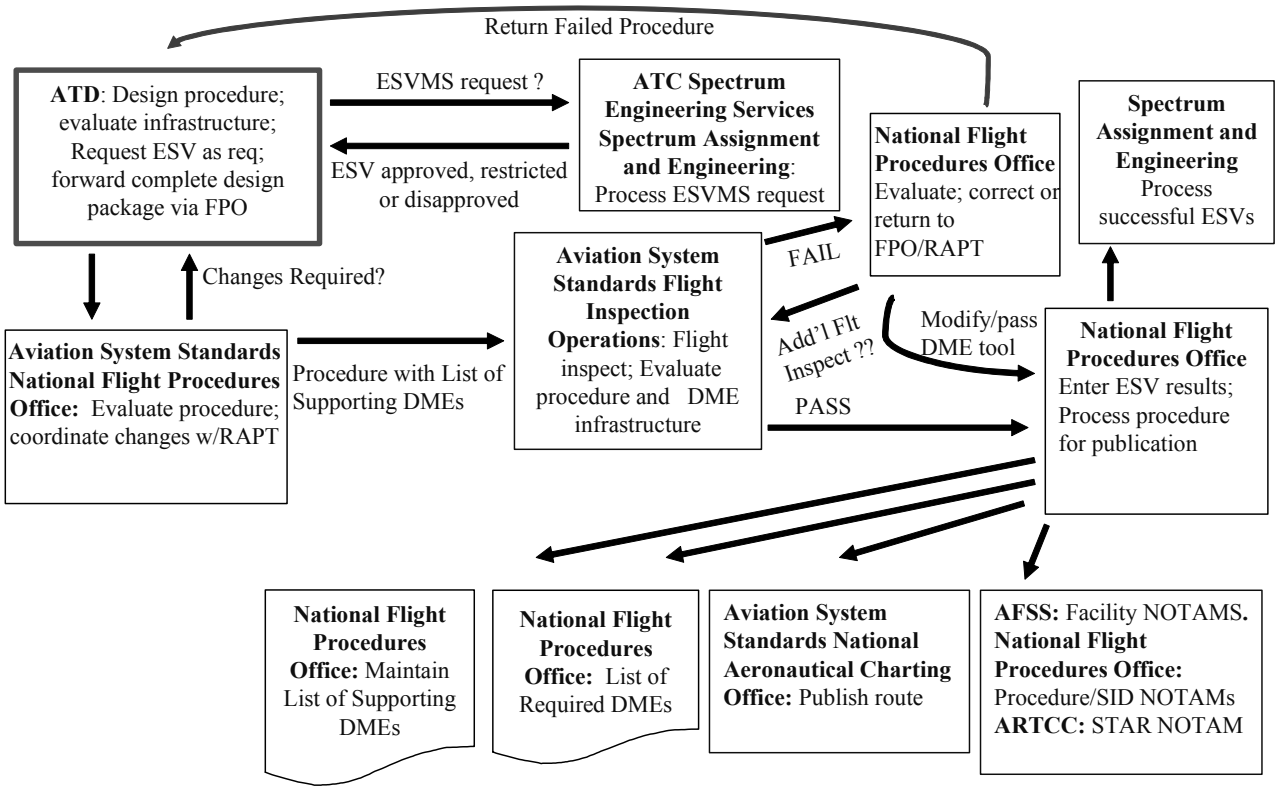
(2) The Terminal Area Route Generation, Evaluation and Simulation (TARGETS) tool is an FAA approved software tool for RNAV Standard Terminal Arrival (STAR) and Standard Instrument Departure (SID) development. Embedded within TARGETS is an interface with the DME/DME infrastructure evaluation tool.

(3) Regional Coordination. Regional Airspace Procedures Teams (RAPTs), chaired by the regional Flight Procedures Offices (FPOs), are established within the FAA Terminal and En

Route & Oceanic Service Areas for the purpose of coordinating, prioritizing, evaluating, approving, and/or denying requests for establishment, amendment, and cancellation of instrument flight procedures. In its facilitative role, the RAPT is responsible for tracking regional procedures from inception to operational implementation in accordance with applicable FAA instructions. This includes ensuring completion of DME/DME infrastructure evaluation and requesting Expanded Service Volume (ESV) for DMEs as needed.

(4) National Coordination. The NAPT ensures consistent application of FAA policy during the development of procedures and, when necessary, resolves problems with the development process. The NAPT will clarify policies and procedures for the RAPT, and when necessary establish national priorities.

FIG 1
DME/DME EVALUATION PROCESS



b. DME Infrastructure Assessment. The DME/DME evaluation tool provides assessment results that include:

(1) Identification of critical facilities. En route procedures, SIDs and STARs may be published with only two DMEs providing a navigation solution at any given point, each of which would be a "critical DME" facility. Loss of one of the critical DMEs results in procedure non-availability for DME/DME only navigation. Where more than two facilities are available and the loss of a particular facility results in loss of a navigation solution, that facility is a critical DME facility.

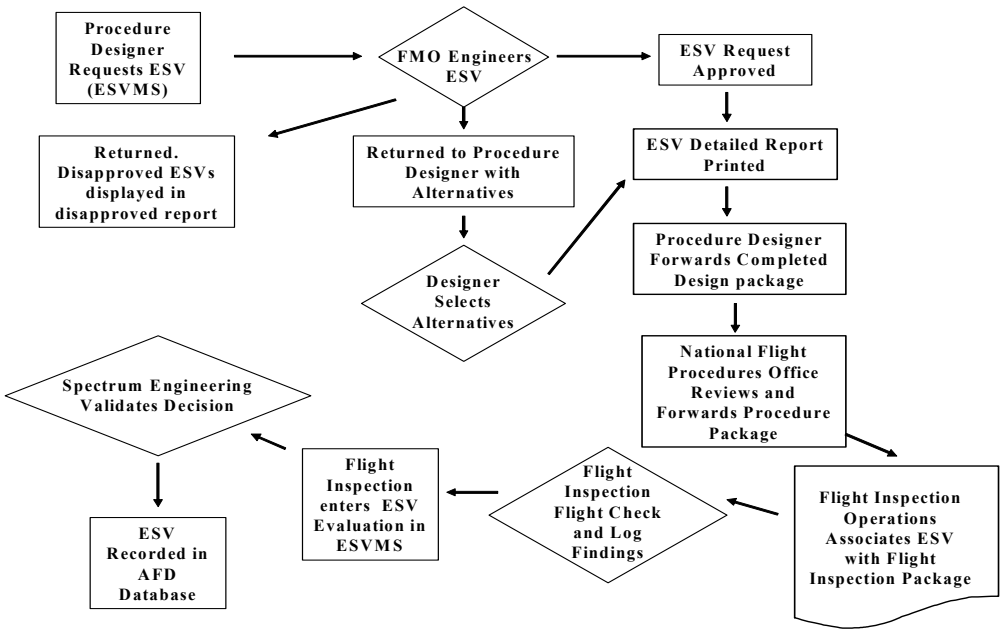
(2) A list of available DMEs and transition points for flight inspection assessment. The list will identify each DME facility as critical or available. If the DME/DME evaluation tool determines insufficient DMEs are available, the procedure will identify gaps in reception and proposed facility Expanded Service Volumes (ESVs) to mitigate the gaps.

(3) A list of other available DMEs and applicable route/procedure segments. This includes facilities which are expected to be available along the route, but which are not required to support the publication of the route.

(4) Identify VOR facilities providing service along a route within a DME coverage gap.

(5) Expanded Service Volume (ESV) requirements. Where the DME infrastructure assessment indicates insufficient DME coverage or critical facilities, the tool identifies proposed ESVs for a subset of DME facilities that should ensure an acceptable navigational solution. ESVs are requested through the Expanded Service Volume Management System (ESVMS), which is internet accessible and managed by the ATC Spectrum Engineering Services, Spectrum Assignment and Engineering Division. Figure 2 details the ESVMS process.

FIG 2
ESVMS PROCESS



(6) Use of DME/Inertial Reference Unit (IRU). The tool is capable of screening procedures emulating aircraft DME/IRU operation. This function is normally off to permit screening using the baseline RNAV system criteria for DME (*AC 90-US RNAV*).

(a) Screening should first be attempted using DME/DME, and then using DME/IRU if DME/DME screening is not satisfactory.

(b) When operationally advantageous or if unable to obtain satisfactory results with DME/DME or DME/IRU, screen the route using a proposed set of ESVs to mitigate navigation gaps.

c. NOTAM Requirements. A national Notice to Airmen system has been established to provide airmen with the current status of the National Airspace System (NAS). Management/operational guidance is contained in Order 7930.2, Notices to Airmen (NOTAMs). NOTAMs provide timely knowledge to airmen, and other aviation interests, of information or conditions that are essential to safety of flight.

(1) A NAVAID NOTAM (D) regarding en route navigation aids, civil public-use airports listed in the AFD, facilities, services, and STARs/SIDs is issued under the Flight Service Station Accountability System and receives the same dissemination as the surface weather report for the originating station.

(a) When a NAVAID monitored at other than a Flight Service Station fails, the monitoring facility shall be responsible for the notification of all affected facilities, including ATC controlling facilities, and coordinate issuance of a NOTAM.

(b) Changes to STARs requiring NOTAM action are promulgated as a NOTAM D. The appropriate ARTCC retains the responsibility for initiating, tracking, and canceling STAR NOTAMs.

(c) Changes to graphic ODPs and SIDs are promulgated as NOTAM Ds. These NOTAMs are developed by Air Traffic Technical Operations National Flight Procedures Office and are issued by the U.S. NOTAM Office (USNOF).

(2) NOTAMs regarding the accuracy and currency of charted terminal and en route flight procedures are issued as FDC NOTAMs by the USNOF. The National Flight Procedures Office is responsible for formulating procedural and airway FDC NOTAMs and forwarding them for transmittal. ARTCCs are responsible for forwarding FDC NOTAM information to affected terminal facilities.

9. ROLES AND RESPONSIBILITIES.

a. Flight Operations Simulation and Analysis Branch (AFS-440). Develop and support the DME/DME Evaluation tool in conformance with the Requirements Document for the FAA DME/DME evaluation tool. Maintain and upgrade the tool. The tool performs assessment of individual routes and procedures, or area assessment of user defined parameters per baseline avionics in *AC 90-US RNAV*.

b. Service Areas. Through the RAPT, the AT Service Area manages the RNAV procedures development process. The RAPT coordinates the activities of the RNAV Implementation Working Group established for development of a particular procedure. The RAPT shall:

(1) Ensure availability of the TARGETS operator for RNAV STAR/SID development. Where training or assistance is needed in the use of TARGETS, coordinate with the Air Traffic System Operations and Safety, Required Navigation Performance (RNP) Program Office. The RNP Program Office will assist the RNAV Implementation Working Group in accomplishing DME infrastructure assessment in circumstances where on-site screening cannot be accomplished.

(2) Use the DME screening tool to perform the DME/DME infrastructure assessment. Air Traffic procedure designers assigned to the RNAV Implementation Working Group will normally perform the assessment using the TARGETS interface feature.

(a) Where TARGETS is unable to access the screening tool via internet or where screening output is inadequate for submission, electronically forward a flight plan profile to the RNP Program Office for assistance. Use the format in Appendix 2 to develop the flight plan profile.

1. For STAR and en route procedures, provide an altitude for each waypoint, route or route segment. Provide the lowest realistic operational altitude ATC anticipates using.

2. For SID procedures no altitude input is required except:

(aa) Provide any ATC crossing restriction altitudes.

(bb) Provide the normal (lowest) operational en route altitude when reached before the end of the procedure.

(b) Air Traffic procedure designers must ensure the altitudes used by Air Traffic are reflected for waypoints or route segments when conducting DME/DME infrastructure assessment. These altitudes impact assessment tool performance and the output provided for flight inspection operations. These altitudes are for screening purposes are not intended for publication.

(c) When advised by the Aviation System Standards, Flight Inspection Operations Division of unsatisfactory flight inspection results, coordinate potential mitigations with Flight Inspection Operations and the RNP Program Office. The RNP Program Office will assist with use of the DME tool to incorporate facilities along the route flight inspection indicates meet the signal-in-space requirements and any limitations associated with those facilities. When complete, reevaluate the procedure or route.

(d) If satisfactory results are then obtained from the tool, follow the ESV request procedure if required and coordinate changes with Flight Inspection Operations. Additional flight inspection may not be required.

(e) When unable to obtain satisfactory results, proceed as in paragraph 9.b.(4)(c) below.

(3) Notify the RNP Program Office when the DME screening tool output indicates foreign facilities within radio reception of a proposed route or procedure. The RNP Program Office will evaluate requirements and coordinate with the Air Traffic Operations Planning, Director of International when an MOU is needed.

(4) Where DME coverage is insufficient for baseline avionics (*AC 90-US RNAV*), DME/IRU performance is inadequate, or when operationally advantageous, ESVs may be requested as follows:

(a) Submit an ESV request using the ESVMS. When approved, the ESV detailed report is returned to the requester for inclusion in the procedure/route submission package.

(b) When restricted, ESVs are returned to the requester with alternatives. The alternatives shall be screened in the DME evaluation tool through custom manual definition of the DME facility characteristics (e.g., ESV sector and range limitations). If acceptable for the procedure, complete the ESVMS process using the alternative, and forward the ESV detailed report with the procedure/route submission package.

(c) Where ESVs are not approved and DME/IRU is not an alternative:

1. Re-design the procedure to obtain the required coverage or

2. Limit the procedure to GNSS equipped aircraft.

(5) Complete procedure design following successful DME infrastructure assessment.

(a) Forward the assessment results output with the procedure submission package to the National Flight Procedures Office via the AT Service Area and regional FPO.

(b) Requests for Q-routes are forwarded to the System Operations and Safety, Airspace and Rules Division for initiation of Notice of Proposed Rulemaking (NPRM) action. Upon receipt of a copy of the NPRM, the AT Service Area forwards a copy of the NPRM to the National Flight Procedure Office via the FPO.

c. ATC Spectrum Engineering Services, Spectrum Assignment and Engineering Division. Process requests for ESVs. Forward approved, disapproved or restricted results to the requesting facility.

d. Aviation System Standards, National Flight Procedures Office. The National Flight Procedures Office reviews STARs/SIDs for conformance with established criteria. The National Flight Procedures Office performs obstruction evaluation of STARs/SIDs and will return any non-conforming STAR/SID to the originating AT Service Area through the FPO.

(1) When necessary, advise and assist the submitting AT Service Area with revisions needed to ensure conformance with criteria.

(2) Forward the procedure to Flight Inspection Operations for completion of the procedure flight inspection.

(3) Review unsatisfactory flight inspection results and coordinate with the submitting AT Service Area, through the regional FPO, potential mitigations for resolution. If mitigations are not possible, return the unsatisfactory STAR or SID to the submitting AT Service Area through the regional FPO.

(4) Following successful completion of the flight inspection, prepare the final STAR/SID procedure package for publication. Forward the final copy to the System Operations and Safety, Aeronautical Information Management Office for further processing, and a copy to the originating AT Service Area through the regional FPO. When ESVs have been requested, forward ESV evaluation results to the Spectrum Assignment and Engineering Division.

(5) Prepare FDC NOTAMS as required by Order 8260.19.

e. Aviation System Standards, Flight Inspection Operations Division. Schedule and perform the flight inspection. Forward flight inspection results to the National Flight Procedures Office. Flight inspection results will:

(1) Measure DME signal coverage and log findings, including any DME proposed for ESV.

(2) Evaluate the route or area with available DMEs and identify facilities not meeting stated accuracy requirements.

(3) When requested, determine the suitability of VOR/DME navigation along the proposed route or procedure.

(4) Provide documentation of DMEs identified to provide the navigation solution.

f. System Operations and Safety, Aeronautical Information Management Office:

(1) Conduct a prepublication review of submitted forms to ensure compliance with applicable directives and resolve data conflicts, form discrepancies, etc., with the National Flight Procedures Office and AT Service Area.

(2) Assign an effective date authorizing charting agencies to publish the route, STAR or SID.

(3) File and maintain the original signed copy of procedure forms.

g. Aviation System Standards, National Aeronautical Charting Office shall:

(1) Advise the RAPT and AT Service Area of any charting issues or publication delays.

(2) Publish the STAR, SID, or route as required on the assigned effective date. Publish a listing of critical DME infrastructure in the appropriate Airport/Facility Directory (A/FD).

h. Air Traffic Operations Planning, Director of International. Provide support for development and coordination of Memorandums of Understanding (MOUs) with foreign authorities as required.

10. OPERATIONAL IMPLEMENTATION

a. Avionics Systems Branch, AIR-130. Develop and publish aircraft/avionics qualification criteria for DME/DME RNAV systems.

(1) Incorporate characteristics of baseline system as minimum requirements.

(2) Establish ground-based navigational facility requirements to support RNAV DME/DME STARs, SIDs, and routes in the NAS, including requirements for TACAN, ILS/ DME and foreign facilities.

(3) Develop criteria for minimum DME/DME/Inertial RNAV system

(4) Update provisions for use of the DME figure of merit (FOM).

b. Flight Operations Branch, AFS-410. Publish operational guidance for operations on RNAV routes and procedures.

(1) Define and document operational and performance requirements.

(2) Ensure criteria are compatible with baseline criteria developed for the aircraft.

(3) Develop guidance for flight planning and operations to ensure pilots understand the impact of critical DME facility outage.

c. System Operations and Safety, RNP Program Office.

(1) Coordinate national DME infrastructure evaluation requirements.

(2) Provide DME infrastructure evaluation training for Air Traffic procedure specialists.

(3) Assist the RNAV Implementation Working Group in accomplishing DME/DME infrastructure assessment.

for Linda M. Schuessler
Vice President, System Operations Services

APPENDIX 1. ACRONYMS, TERMS, AND DEFINITIONS

Acronym/Term	Definition
Available DME	A DME facility whose Operational Service Volume (OSV) covers all, or a portion, of a route or procedure.
Critical DME	A DME facility that when unavailable results in inadequate DME/DME RNAV system performance to sustain operations along a specific route or procedure. The required performance assumes an aircraft's RNAV system meets, but does not exceed the minimum standard (baseline) for DME/DME RNAV systems found in Advisory Circular *90-US RNAV*.
DME	Distance Measuring Equipment. The term "DME" is a generic term for any ground-based navigational aid facility that responds to DME interrogations, including different types and/or combinations of co-located DME and Tactical Air Navigation (TACAN) facilities (e.g., NDB/DME, VOR/DME, VORTAC, TACAN, ILS/DME).
DME/DME Coverage	DME/DME coverage exists where the availability of DME facilities permits the minimum standard RNAV system defined in FAA Advisory Circular *90-US RNAV* to achieve better than 1.75 NM (95%) navigation accuracy. DME/DME coverage requires at least two DME facilities operating within their OSV.
ESV	Expanded Service Volume (ESV) – ESVs are used to designate a service volume larger than the standard service volume. If a DME facility requires an ESV in order to serve as an available DME for an RNAV route or procedure, then the ESV shall not exceed the following limitations: • Terminal DME facilities – ESVs must be less than or equal to 70 NM from the facility. • Low-Altitude DME facilities – ESVs must be less than or equal to120 NM from the facility. • High-Altitude DME facilities – ESVs must be less than or equal to 160 NM from the facility.

Note: * Maximum ESV distances for Terminal, Low-Altitude, and High-Altitude DME facilities are subject to future modification.

Flight Plan	The term "flight plan" as used in this document, refers to an input file consisting of a series of route/procedure related fields. The input file fields include waypoint name, waypoint latitude and longitude, aircraft altitude at waypoint, climb logic (i.e., Step or VNAV), airspeed, waypoint type (i.e., fly-over or fly-by), and RNAV leg type.

Flight Track	The term "flight track" refers to an input file consisting of a series of sequential latitudes, longitudes, and altitudes that defines the exact position of the aircraft as it flies the route or procedure.
OSV	Operational Service Volume – Includes the SSV (minus any restricted areas) and any approved ESVs. The OSV shall not extend beyond the frequency-protected service volume on any radial from the facility, at any distance from the facility, or at any altitude beyond the altitude spectrum defining the facility's service.
Required DME	A DME facility that if it fails flight inspection or does not receive approval for a proposed ESV, then DME/DME coverage is not available, and the proposed route or procedure requires re-evaluation or redesign.
(Route) Segment	A portion of a route along which DME coverage is provided by up to five facilities. Segments vary in length and are predicated on tool determined changeover points between facility subsets.
SSV	Standard Service Volume – The three-dimensional volume of airspace within which NAVAID performance meets specified performance criteria and is free of interference and co-channeling. The DME evaluation tool assumes the following SSV for each class of DME facility: • Terminal DME Facility: 25 NM from the facility (from 12,000' down to 1,000' above the facility). Below 1,000' coverage area takes the shape of a parabolic cone. • Low-Altitude DME Facility: 40 NM from the facility (from 18,000' down to 1000' above the facility). Below 1,000' coverage area takes the shape of a parabolic cone. • High-Altitude DME Facility: 100 NM from the facility (from 60,000' down to 45,000' above the facility); 130 NM from the facility (below 45,000' down to 18,000' above the facility); 100 NM from the facility (below 18,000' down to 14,500' above the facility); 40 NM from the facility (below 14,500' down to 1,000' above the facility). Below 1,000' coverage area takes the shape of a parabolic cone.

Appendix 2. Required Data for RNAV-Pro Evaluation

Waypoint ID	Type	N/S	Latitude	E/W	Longitude	Altitude	VNAV/Step	IAS	Fly-By/Over	Turn Dir	Leg Type	CF Course	Approach	MinRoC	CutOffAlt
(SID EXAMPLE)															
RW17C (AER)		N	325436.63	W	1000133.61									500	5000
NICLE		N	325146.01	W	1000134.53	1080			FO		CF	180.26		500	5000
NAVYE		N	324657.75	W	995942.05				FB		TF			500	5000
JGIRL		N	324554.36	W	995621.63	5000			FB		TF				
(STAR EXAMPLE)															
LGC	WP	N	330256.74	W	851222.30	18000			FB		TF				
HONIE	WP	N	331101.60	W	850142.97	12000		250	FB		TF				
TIROE	WP	N	331823.45	W	845157.52	11000		250	FB		TF				
FOGOG		N	333154.00	W	0843351.00	5000		220	FB		TF				
NOVSS	WP	N	333154.00	W	0841911.00	4000		220	FB		TF				
HEDEG	WP	N	333154.00	W	840755.00	3000		210	FB		TF				
SOFOR	WP	N	333153.00	W	840020.00	3000		210	FO		TF				

Waypoint ID: Use the name/ID of the fix. The first fix for a SID **MUST BE** the AER. REQUIRED ENTRY.
Type: No entry required. Default to WP if no entry is made.
N/S: North/South Hemisphere, entered as N or S. REQUIRED ENTRY.
Latitude: Enter in ddmmss.ss format. REQUIRED ENTRY.
E/W: East/West Hemisphere, entered as E or W. REQUIRED ENTRY.
Longitude: Enter in ddmmss.ss or dddmmss.ss format. REQUIRED ENTRY.
Altitude: REQUIRED ENTRY at EACH WP on STAR & Q-Route. Enter the lowest operational alt for ATC use.
Entry not required at each WP on SID; enter crossing restrictions and lowest final operational altitude for ATC use if applicable.
VNAV/STEP: Defaults to STEP and will climb/descend to the altitude identified at the next waypoint; VNAV will fly a smooth profile. No entry required.
IAS: Defaults to indicated airspeed in knots appropriate for segment type/altitude. Enter required speed restrictions; include for following WPs until normal speed is desired. No entry required.
Fly-By/Over: Defaults to Fly-By (FB); Enter Fly-Over (FO) if required.
Turn Dir: Turn Direction, defaults to least amount of turn. Leave blank except for course reversals or unusual fly-over turns.
Leg Type: ARINC leg type used to reach specified waypoint. Defaults to TF leg type if no entry is made.
CF Course. Course used to reach specified waypoint, entered in MAGNETIC degrees. REQUIRED ENTRY for CF leg types.
Approach: For an approach, enter segment: INITIAL, INTERMEDIATE, or FINAL.
MinRoC: Enter minimum rate of climb required from specified waypoint to the next waypoint in FT/NM if other than standard.
Cut off Altitude: MSL altitude to which RoC must be maintained. If RoC is specified as 500 ft/nm until 5000 ft MSL, place 500 in MinRoC block and 5000 in this one.

APPENDIX 3. AIRWAY FACILITY ASSUMPTIONS

1. Background. Prior to procedure design and operational implementation, airway facility performance standards must be documented. ICAO performance standards listed in ICAO Annexes 4, 11, 14 and 15 should be compared against FAA airway facility standards to determine the degree of achievable DME/DME RNAV performance.

2. Collocation. The geographic coordinates of the VOR component are reported as the facility position in the Airport/Facility Directory. ICAO Annex 10 allows a 2000 foot difference between the VOR and DME collocated components. Reference AC 00-31A, *United States National Aviation Standard for the Very High Frequency Omnidirectional Radio Range (VOR)/Distance Measuring Equipment (DME) / Tactical Air Navigation (TACAN) Systems*, dated 9/20/82, offset collocation is defined as follows (para 25.b.):

a. For those facilities used in terminal areas for approach purposes or other procedures where the highest position fixing accuracy of system capability is required, the separation of the VOR and DME or TACAN antennas will not exceed 100 feet (30 meters).

b. At Doppler VOR sites, the antennas may be separated by not more than 260 feet (80 meters).

c. For purposes other than those indicated in 2.a., the separation of the VOR and either the DME or TACAN antennas will not exceed 2000 feet (610 meters).

3. Airway Facility Performance Assumptions.

a. DME/TACAN facilities classified as “collocated” but not within 30 meters of the same VOR vertical axis (Ref ICAO Annex 4: 7.9.3.1.1; 8.9.4.1.1; 9.9.4.1.1; 10.9.4.1.1), should be published with separate geographic coordinates in the Airport/Facility Directory.

b. Ensure VORTAC or DME facility movement remains within 30 meters of published coordinates. DME facilities not meeting facility survey and notification requirements and/or DOD TACANs should not be used for DME/DME RNAV.

4. Survey accuracy and publication resolution.

a. FAA Specification 405 states horizontal survey accuracy of 20 feet when located on public use airports and military fields, and 50 feet horizontal accuracy elsewhere.

b. The National Flight Data Center (NFDC) publishes navigation aid data in degrees, minutes and seconds, accurate to four decimal places (for example, N35 35 04.5435 W97 23 05.0234). This data is contained in the National Airspace System Resource Aeronautical Data files.

c. The publication resolution of all en route DME/VORTAC facilities is accurate to one-hundredths of a minute when published in the Airport /Facility Directory.

d. The navigation aid resolution in ARINC 424 specifications can accommodate survey measurements accurate to one-hundredths of a second (1 foot) for electronic database use.

e. By comparison, ICAO Annex 15, Amendment 14, lists a publication accuracy of at least one-tenth of a minute. ICAO Annex 11, Chapter 2 (Aeronautical Data) and Appendix 5 state determination and reporting of aeronautical data for en-route navaids shall be 100 meters (surveyed/calculated) and DME elevation accuracy shall be 30 meters (100 feet) surveyed.